formed by the ethmoid and surrounding structures, as is well displayed in the text-figures, which resemble puzzles of an unusually complex type. Very unexpected is the discovery that the structure of the ethmoid divides the more typical Ungulates into two groups, one represented by the Ruminants and the other by the Suina and the Perissodactyla. As this grouping so completely traverses the classification indicated by other parts of the organisation, it may be that the feature in question is purely adaptive. In the general structure of the ethmoid the elephant resembles more typical Ungulates. The second of the above-mentioned memoirs is a continuation of Dr. B. Haller's study of the Vertebrate brain; the present section dealing with the Pond-Tortoise (*Emys orbicularis*). At the conclusion of his paper the author refers to the structural resemblances between the reptilian brain on the one hand and that of Monotremes and Marsupials on the other. He is led to conclude that a commissure connecting the hemispheres of the brain was developed in an extinct forerunner of the reptiles, which formed the ancestral type of both the Sauropsida and the Mammalia.

TWENTY years ago the late Dr. Dobson described a new species of Australian bat, remarkable for its white head and lower surface of the body, under the name of *Megaderma gigas*. From that time to this the species has been known solely by the type specimen—a male. In No. 7, vol. iii. of the *Records* of the Australian Museum, Mr. E. R Waite describes a second example, this time a female, obtained in West Australia. To the same journal Mr. Waite likewise contributes a paper on additions to the fish-fauna of Lord Howe Island, in the course of which he describes four new species, one of them being assigned to a new genus. Several of them belong to the coral-eating Chætodonts. The author draws attention to the circumstance that since the transparent larval form to which the name Leptocephalus was assigned in 1763 is now ascertained to be the young of the Conger-eel, the generic title Conger has to give place to Leptocephalus. As this latter name is now no longer available for other similar larvæ of which the adults are unknown, he adopts for them the name Atopoichthys, lately proposed by Garman.

THE July number of the *Biologische Centralblatt* contains an interesting note by Dr. R. Stölzle on the position taken by K. E. von Baer with regard to the origin of the human race. Reference is made to von Baer's opposition to the doctrine of descent from lower animals (1) in pre-Darwinian times; (2) after the appearance of "The Origin of Species"; and (3) after the publication of "The Descent of Man."

CAPTAIN R. H. ELLIOTT, who has been for some time conducting researches into the nature and action of snake venom in India, arrives at the following conclusions in the *British Medical Journal*:—(1) The snakemen of South India are certainly ignorant of any method of producing in themselves a highly-developed condition of immunity. (2) Some few of them appear to practise the swallowing of venom, or the inunction of venom into their limbs, but it is doubtful if they do so with any well-defined object. It is possible that they thus obtain some degree of immunisation. (3) They confine themselves almost exclusively to the cobra, and escape harm by their intimate knowledge of the methods of handling this snake.

A COPY of the second edition of a catalogue of the fossils in the students' stratigraphical series of the Woodwardian Museum, Cambridge, by Mr. H. Woods, has been received.

THE plants collected on the Antillean cruise of the yacht *Utowana*, in Bermuda, Porto Rico, the Caymans, Cozumel, Yucatan, and the Alacran shoals, between December 1898 and March 1899, are described, under the title *Plantae Utowanae*, by Dr. Charles Frederick Millspaugh, in vol. ii. No. 1 of the botanical series of the Field Columbian Museum.

PROF. W. H. CORFIELD'S two Harveian lectures on disease and defective house sanitation have been translated into Hungarian by Dr. Frank, of Budapest, for the Royal Society of Public Health of Hungary. Dr. Frank remarks in the preface that the lectures "merit the attention of Hungarian readers because they explain the views of a prominent English hygienist, and also because the sanitary arrangements of dwellings in Hungary are much more unsatisfactory than those in England."

THE additions to the Zoological Society's Gardens during the past week include a White-fronted Capuchin (*Cebus hypoleucus*) from Central America, presented by Mr. W. H. Laws; a Two-spotted Paradoxure (*Naudinia binotata*) from West Africa, presented by Mr. Robert H. Gush; a Levaillant's Amazon (*Chrysotis levaillanti*) from Mexico, four Lorikeets (*Trichoglossus rubritorques*) from North-west Australia, six Roofed Terrapins (*Kachuga tectum*) from British India, two Alligator Terrapins (*Chelydra serpentina*), an American Box Tortoise (*Cistudo carolina*), a Sculptured Terrapin (*Clemmys insculpta*) from North America, deposited; two —— Buntings (*Emberiza sulphurata*) from Japan, purchased; an Altai Deer (*Cervus eustephanus*), three Crested Pigeons (*Ocyphaps lophotes*), a Spotted Pigeon (*Columba maculosa*), four Vinaceous Turtle Doves (*Turtur vinaceus*), bred in the Gardens.

OUR ASTRONOMICAL COLUMN.

COMET BORRELLY BROOKS, 1900 *b*.—Several telegrams received from the *Centralstelle* at Kiel announce the appearance of a new comet in the constellation Aries. The following are the positions given:—

1900	R. A. h. m. s.	Decl.	Observer.
July 23d. 12h. 50·0m. (Marseilles Mean Time)	2 43 33	+11° 51′	Borrelly.
July 23d. 13·00h. (Geneva Mean Time)	2 43 40	+12° 30′	Brooks.
July 24d. 12h. 57·1m. (Strassburg Mean Time)	2 44 26	+14° 32′ 42″	Kobold.

A later circular from Kiel furnishes an ephemeris for further observations of the comet, prepared by Herr J. Möller from measures of July 24, 25 and 26.

Elements.

T = 1900 Aug. 3, 298. Berlin Mean Time.

ω = 12° 30·2
Ω = 328 1·8 } 1900·0.
ι = 62 35·6
log q = 0·00636

Ephemeris for 12h. Berlin Mean Time.

1900.	R.A. h. m. s.	Decl.	Br
Aug. 1	2 53 52	+38° 31·5	1·12
3	2 57 12	44 37·1	1·10
5	3 1 8	50 29·1	1·08
7	3 5 55	56 2·1	1·05
9	3 11 45	+61 11·9	0·91

CATALOGUE OF DOUBLE STARS.—The *first* volume (1900) of the *Publications of the Yerkes Observatory* of the University of Chicago has recently been distributed; it contains a list of 1290 double stars, discovered from 1871–1899 by Prof. S. W. Burnham, now on the staff of the Yerkes Observatory. The majority of the measures have hitherto only been published in sections, comprising portions of nineteen different catalogues, and the work of bringing so large a mass of material together was commenced during the author's connection with the Lick Observatory (1888–1892). While working with the large instrument there, many of the more difficult pairs were re-measured, and their positions carefully re-determined by comparison with the newer star catalogues of the *Astronomischen Gesellschaft*, Cordoba, &c., instead of those of Lalande and Argelander. As, however, in the present work no attempt has been made to supersede other star catalogues with respect to the absolute positions, it has not

been thought worth while to bring the co-ordinates past the epoch 1880.

Commencing astronomical observations in 1861 with a very small instrument, Prof. Burnham obtained a six-inch equatorial from Alvan Clark in 1869, with which he commenced systematic work on double stars in 1872. Since that time his observations have been made with instruments of varying aperture, 9·4, 12, 15·5, 16, 18·5, 26, 36 and 40 inches respectively.

Especially interesting is the fact that a great proportion of the pairs discovered have been found to be physically binary, and that these are generally closer and more difficult to measure compared with those in slower motion.

A special list of quadruple stars is given, and various measures have been obtained by the co-operation of other observers with different instrumental equipment. The stars are arranged in order of right ascension; and besides the present elements, a short description of special particulars with comparative previous measures are added to each where necessary, and several illustrations are given of the instruments used in the course of the work.

SOME RESULTS OBTAINED WITH A STORAGE BATTERY OF TWENTY THOUSAND CELLS.[1]

THE remarkable development of practical employments of electricity have put the professor of physics at a disadvantage, compared with the electrical engineer. The latter has at his service thousands of electrical horse-power, while the college instructor can barely obtain fifty. The engineer can experiment with enormously strong currents and study their effects in chemical industries, and in the production of intense heat. Thus the study of the manifestations of electricity on a great scale seems to be relegated to the electrical engineer.

There is one direction, however, in which the university professor can enter into competition with the engineer and even surpass him in resources. This direction is in the field of high electromotive force; and I wish to call your attention to some results which I have obtained with a storage battery of twenty thousand cells. For several years I have had at my command ten thousand cells; and the plant has proved so practical that I resolved last autumn to double the number of cells. The battery is now finished, and you will have an opportunity of seeing its manifestations.

With twenty thousand cells of the Plante type I can obtain forty-two thousand volts, and by the use of Leyden jars I can step up to three million. I cannot go higher, for the very interesting reason that air at atmospheric pressure becomes a fairly good conductor beyond two million volts, and it is impossible to charge Leyden jars to this potential, or to produce sparks in a laboratory of greater length than seven feet. To obtain the greatest manifestations of three million volts, it would be necessary to put the apparatus in an open field at least thirty feet from the ground, and remote from all other objects. Jars and circuits charged to this high voltage emit a luminous discharge to the floor of the room and to the brick walls, and indicate by this inductive discharge the presence of steam pipes twenty feet distant. The air breaks down quickly under this powerful electric stress, and, indeed, acts like a rarified gas.

Nevertheless discharges of electricity six and seven feet long are of interest, especially to many of you who are citizens of Boston, where Benjamin Franklin was born. These discharges closely resemble lightning, and one can reproduce all the photographic effects obtained by students of this astounding natural phenomenon. I have discovered the interesting fact that these long sparks are oscillatory.

The method of proof is this: I connected the condensers which were used in series to produce the high potential of three million volts, in multiple with a known self-induction. The discharge was then photographed. Here is one of the results: The distance between these bead-like figures from centre to centre represents one five-thousandth of a second (Fig 1). When the condensers are connected in series through the same self-induction the discharge still remains oscillatory, but of a much higher period; we are sure of this fact from Lord Kelvin's discussion of the limits of oscillatory action. You will perceive from Fig. 1 that I have been able, by means of the large battery and the large condenser, to photograph comparatively slow oscillations. I have lately succeeded in obtaining photographs of oscillations eight hundred a second; and experiments on the permeability of iron wire with powerful discharges with such low periods are now in progress.

That most discharges of lightning are to-and-fro, or oscillatory, I feel sure, and I have outlined my method of proof; but this was hardly necessary, for the photographs of the long sparks show on mere inspection the to-and-fro motion, for on the line of discharge forks can be observed pointing in opposite direc-

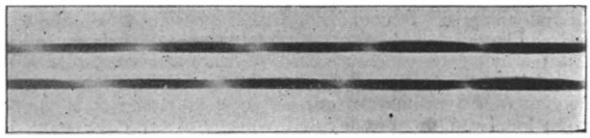

FIG. 1.

tions, showing that the discharge changed from positive to negative. These forks, or branching discharges, have an interesting peculiarity, which was brought out in the following manner. A sheet of plate glass about five feet square was placed between the terminals of the high potential apparatus, and a minute hole was bored in the middle of this plate.

This hole could be made very small by plugging the orifice with paraffin, and making needle-holes in the paraffin. When the spark terminals were opposite the hole, each a foot and a-half

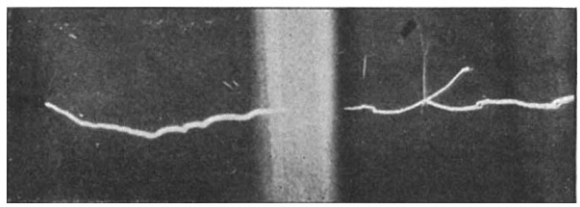

FIG. 2.

from it, the spark sought the hole. A photograph of the spark (Fig. 2) shows an apparent breadth of spark much greater than the diameter of the hole; indeed, the minute size of the latter cannot be reproduced on the negative; while the spark seems to the eye to be an eighth of an inch in thickness, and actually measures about a millimetre in diameter on the negative. The reason of this phenomenon, I believe, is that only a portion of the discharge passes through the hole. This can be shown in the following manner. The terminals were not placed oppo-

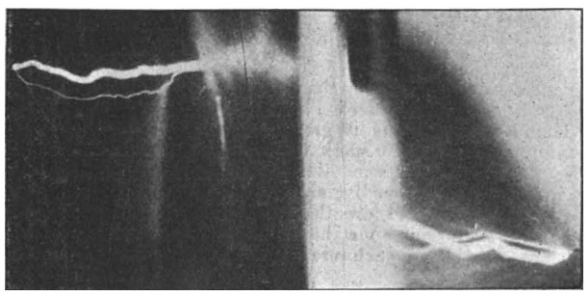

FIG. 3

site the hole, but to one side of it, about a foot from it, and about half a foot from the glass. The discharge then jumped to the glass (Fig. 3), and pursued a devious way to the hole. When the hole was completely filled with paraffin the spark still jumped to the glass, apparently piercing a hole through it; but this was impossible, for the thickness prevented this. The discharge was continued evidently by an inductive action. I next restored the orifice, and, keeping the spark terminals in the last position referred to, I hung a large sheet of paraffined paper

[1] Paper read by Prof. John Trowbridge at a meeting of the American Academy of Arts and Sciences, held in the Jefferson Physical Laboratory, Harvard University, Cambridge, U.S.